PROGRAM

NINTH ANNUAL MEETING

of the

American Association of Jesuit Scientists

Eastern States Division

HOLY CROSS COLLEGE

Worcester, Massachusetts

August 12, 13, 14, 1930

PROGRAM OF GENERAL MEETINGS

TUESDAY, AUGUST 12, 7.45 P. M. CHEMISTRY AMPHITHEATRE
O'KANE BUILDING

Address of Welcome - - - Rev. John M. Fox, S. J.

Reading of Minutes. Appointment of Committees.

PRESIDENTIAL ADDRESS - - Rev. Richard B. Schmitt, S. J.

"THE NEED OF METHOD IN SCIENCE."

New Business. Adjournment.

THURSDAY, AUGUST 14, 1.00 P. M. CHEMISTRY AMPHITHEATRE

Reports of the Secretaries. Reports of Committees.

Discussion. Resolutions.

Election of Officers. Adjournment.

PROGRAM OF SECTIONAL MEETINGS

Biology Section

WEDNESDAY, AUGUST 13, 9.00 A. M.—3.30 P. M.
BIOLOGY LECTURE ROOM.
BEAVEN HALL

THURSDAY, AUGUST 14, 9.00 A. M.

CHAIRMAN'S ADDRESS - - Rev. John A. Frisch, S. J.

"THE TRAINING OF BIOLOGY TEACHERS."

A Comparative Study of Mushrooms..................Rev. H. L. Freatman, S. J.

The Function and Fate of the Foramen Ovale....Rev. F. X. Reardon, S. J.

Changes in the Genital Fold which
Determine the Position of the Ovary............Rev. C. E. Shaffrey, S. J.

The Gene ....Charles A. Berger, S. J.

Biology Clubs In High Schools.......... ....James L. Harley, S. J.

Did the Ammophila Urnaria of the Peckams
Use a Pebble as a Tool? ....Rev. J. A. Frisch, S. J.

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Chemistry Section.

WEDNESDAY, AUGUST 13, 9.00 A. M.—3.30 P. M.

CHEMISTRY LECTURE ROOM.
O'KANE BUILDING

THURSDAY AUGUST 14, 9.00 A. M.

CHAIRMAN'S ADDRESS - - Rev. G. F. Strohaver, S. J.

"THE CO-PRECIPITATION OF COPPER BY NICKEL DIMETHYL GLYOXIME AS A FUNCTION OF pH."

A Study of the Electrolytic Determination of Copper in the Presence of Platinic Ion......Joseph J. Malloy, S. J.

The Effect on Certain Physical Properties of Picrates ......Edward S. Hauber, S. J.

A Glass Automatic Electric Still......Lawrence C. Gorman, S. J.

Sublimation of Oxalic Acid under Reduced Pressure. ......Rev. T. J. Brown, S. J.

Separation of Cobalt and Nickel by Sodium Hypochlorite ......Rev. R. B. Schmitt, S. J.

Bromination of Chloroform in the Vapor-phase. Rev. J. J. Sullivan, S. J.

The System: Water, Chloroform and Acetic Acid ......Anthony J. Carroll, S. J.

Synthesis of the Fluor Hippuric Acids......Albert F. McGuinn, S. J.

Report on Chemical Research in Our Colleges
by the Respective Heads of Departments.

Mathematic Section

Meetings in conjunction with the Physics Section.

CHAIRMAN'S ADDRESS - Rev. F. W. Sohon, S. J

"THE AXIOMS OF MATHEMATICS."

A Few Short Cuts in Mathematics......William D. Sheehan, S. J.

Mathematics of Pre Christian Centuries......George P. McGowan, S. J.

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Physics Section

WEDNESDAY, AUGUST 13, 9.00 A. M.—3.30 P. M.

PHYSICS LECTURE ROOM.
ALUMNI HALL

THURSDAY, AUGUST 14, 9.00 A. M.

CHAIRMAN'S ADDRESS - - Rev. T. J. Love, S. J.

"ORIGIN AND PRESENT STATUS OF THE ETHER THEORY."

SYMPOSIUM: THE ELECTRON.

On the Track of the Cathode-Electron Rays............Rev. E. B. Berry, S. J.

Some Properties of the Electrons ....James D. Loeffler, S. J.

Determination of the Charges on the Electron................Leo F. Fey, S. J.

The Existence of Free Electrons in
Metallic Conductors ....Rev. J. J. Lynch, S. J.

The Piezzo Electric Effect .... Rev. J. A. Tobin, S. J.

The Emission of Electrons by Light......................Rev. J. P. Merrick, S. J.

Some Applications of this
Photo-Electric Effect ....J. T. O'Callahan, S. J.

The Electronic Theory of Magnetism......................Joseph L. Murray, S. J.

Are Electrons Waves? ....Rev. H. M. Brock, S. J.

The Shortt Synchronome Clock...............................Rev. J. S. O'Connor, S. J.

WEDNESDAY, AUGUST 13, 7.30 P. M. AUDITORIUM

The Eclipse of April 28, 1930, Rev. J. A. Blatchford, S. J.

(Illustrated.)

Exhibition and demonstration of latest scientific apparatus by

Bausch and Lomb Optical Company, Rochester, N. Y.

Central Scientific Co., Chicago, Ill.

Laboratory No. 4 O'Kane Building.

Please send in the abstracts of papers to the Secretary.

Closing date: September 15, 1930.

American Association *of* Jesuit Scientists

EASTERN STATES DIVISION

PROCEEDINGS

of the

NINTH ANNUAL MEETING

HOLY CROSS COLLEGE
WORCESTER, MASSACHUSETTS
AUGUST 12, 13, 14, 1930

VOL. VIII NO. 1

Holy Cross Convention, 1930.

BULLETIN OF AMERICAN ASSOCIATION OF JESUIT SCIENTISTS

EASTERN STATES DIVISION

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PROCEEDINGS

FIRST GENERAL SESSION

The ninth annual meeting of the American Association of Jesuit scientists, Eastern States Division, was held at Holy Cross College, Worcester, Massachusetts, on August 12-14th, 1930. The general meeting was called to order by Rev. Richard B. Schmitt, at 7:45 P. M. in the Chemistry Amphitheatre.

The minutes of the previous meeting and the treasurer's report were accepted as read. The Chairman read a letter from Very Rev. Fr. Provincial expressing regret at his inability to attend, but wishing all success and God's blessing on the meeting. Letters from Fr. Morgan, former president, and from Fr. Vollmayer, president of the Mid-Western Division were also read.

A letter from the president of the Philosophers Association, in reply to that sent by the President of the Science Association, resulted in the appointment of a committee consisting of representatives of both associations to discuss means whereby the scientific theories might be taught harmoniously by both departments in our schools. This committee consisted of:

Representatives of the Philosophers Association—

Fr. F. Lucey
Fr. J. Keyes
Fr. W. Graham

Representatives of the Science Association—

Fr. J. Didusch
Fr. H. Brock
Fr. G. Strohaver
Fr. J. Lynch

A suggestion was made by the chairman that some fitting remembrance of the late Fr. Tondorf be made by the Association. Detailed discussion of this proposal was postponed till the next meeting.

The chairman named the following committees:

Committee on Nominations:—

Fr. Brock, *Chairman*
Fr. Coyle
Fr. Kolkmeyer

Committee on Resolution:—

Fr. Shaffrey, *Chairman*
Fr. Lynch
Fr. Dore

PRESIDENTIAL ADDRESS

THE NEED OF METHOD IN SCIENCE

Rev. R. B. Schmitt, S. J.

We are living in an age of scientific and industrial progress intermingled with a voracious desire for diversified education. The phenomenal increase in the number of students in universities, colleges, technical and high schools in the past few years is evident. Have our methods of education progressed proportionately with our educational experiences and the vast increase of the number of students? Because of the phenomenal advance in our present day science, our educational methods must be more exacting and more precise to keep abreast of this unusual development. What is the essential feature of progress and success in individual advancement, in industrial progress, in educational methods and in scientific research? We venture to say that it is METHOD,—which means, system or organization. We, as Professors of Science, have experienced the need of method in preparation for instructions, method in giving lectures, method in laboratory work and method in research. Method too, is the underlying principle of the directions given to us in the "Ratio Studiorum" in 1599 and 1832. The absence of method is detrimental to progress and impairs the proper functioning of any system, whether industrial, educational or purely scientific. Dr. Joseph Colt Bloodgood, Director of the Garvan Cancer Research Laboratory, Clinical Professor of Surgery of the Johns Hopkins University makes this observation: "The chief criticism in regard to research from the beginning, and especially now, is the lack of organization and the lack of cooperation between all the sciences. The hope of discovery of the cause, prevention and cure of cancer belongs to one science. The practical conclusion is, there should at once be more cooperation and an attempt at better organization between all the sciences and investigating activities of the medical schools and universities throughout the world."

We might then consider the meaning and essential qualities of method as applied to science. By method, we mean an assemblage of rational procedures in the search for and the demonstration of truth. The diversity of the objects of science entails the diversity of methods. However, the common object of science being the same, the discovery of the causes of things, the particular methods should present procedures and universal rules, the sum total of which constitutes a general method applicable to all the sciences. Experimental analysis and synthesis applied to the concrete sciences operate on facts or real beings. These methods are usually called the chemical methods because of the great use which chemistry makes of them. This experimental anaylsis consists in decomposing a complex being into its elements, and is effected in two ways: first, by real division of parts, if there is question of material beings and sensible phenomena as happens in the physical and biological sciences. Thus the physicist de-

composes white light into violet, indigo, blue, green, yellow, orange and red;—the botanist seperates the different organs of the flowers, in order to understand the relations of their dependence; the anatomist dissects the human or animal body in order to understand the functioning of the organs and their mutual subordination. Secondly, this decomposition is effected by abstraction, where there is question of immaterial substances as we find in the psychological and metaphysical sciences. And so, analysis does not consist merely in dividing a compound into its elements, but principally in explaining the compound or complex by its elements, and in causing their mutual relations to be known. Experimental synthesis consists in forming a compound by the reunion of its elements; and this too can be brought about in the same two ways.

Analysis proceeds from the complex to the simple, that is, beginning with obscure and complex notions it clarifies them by relating them to other notions that are clear and distinct. Synthesis proceeds from the simple to the complex, that is starting with clear and distinct notions it makes use of them to clarify other notions that are obscure and confused. Analysis breaks up and provides the simple elements of things to synthesis which follows it and coordinates these elements to build up the edifice of science. The human mind is too weak to grasp complex truths at a single glance, there must be division of the work. Vague and ambiguous ideas must be freed from obscurity by analysis and in this way we attain to the last and irreducible elements of knowledge the evidence of which is imposed on the mind.

Analysis and synthesis are, each taken by itself, a complete method which is sufficient to itself,—and not two successive and necessary phases of method. Wherever one can be applied fully, it is not necessary to use the other. Since analysis does not consist only in dividing a compound in its elements, it consists above all in comprehending the relations of the whole with its parts. Thus understood, analysis can solve a scientific problem as completely as synthesis.

The synthetic method gives to the mind a greater satisfaction, since it follows the natural order; in the logical order the principle is before the consequence; in the real order the cause is before the effect which results from it. This progressive procedure causes us, as it were, to attend to the origin of truths, of beings and of phenomena. It is for this reason that synthesis is usually considered as the method best adopted to the exposition and teaching of known truths. Analysis, however, is ordinarily regarded as the method of investigation and discovery of unknown truths, because it starts from effects and consequences which are generally better known to us than causes and principles, at least in the concrete sciences. In teaching, that method should be chosen which according to the matter to be taught is found to be the clearest. Usually synthetic methods are adopted as the methods for exposition, however, if the truth to be explained has been found analytically, it should proceed in like manner. In this way

the student will be as it were, a witness of the discovery; furthermore, it is the means of developing in him the spirit of invention which is characteristic of research.

If our students acquire the habit of trying to find out a new fact in their work in the various sciences, they are acquiring the essential method for scientific research. Everyday we read, we see, we hear about new discoveries in science due to the intensive use of this method. Our daily literature is replete with new devices and new scientific progress of older methods. Notwithstanding all that has been learned in the past ages, the problems that have been solved are almost insignificant compared with those that remain to be solved. We can say with great assurance, that every important discovery suggests new problems. If this habit or method of ever finding the new in our sciences would stimulate our own labors and be transmitted to the students, scientific progress in our colleges and universities would be assured.

No matter what recognized plan we may have for advancement in study, in lecture, in laboratory or in research there must be present a well defined and a well organized method. With method success is certain, without method there will be inevitable loss of time. The very purpose of this convention is to put method and organization in the exposition of the sciences in the lecture-room, in laboratory work, in private study or in research. Now is the time to put method or order in gathering information for our own storehouse of knowledge with the difficulties we met during our recent teaching experiences; now we might discuss better methods of pedagogy for our science courses; lecture and laboratory methods are varied in our educational system, and now is the time to systematize them by lively discussion which will lead to better organization and to the highest standards of Jesuit education. In fine, no matter what our endeavors are, whatever science we are laboring at, no matter how large or small our audience may be, whether our work is in the lecture-room or in the laboratory, either in undergraduate work or in the profoundest research, there must ever and always be a definite plan, a deliberate order and that is method in science.

* *

On Wednesday, August 13th, at 9.00 A. M. and at 3.30 P. M., and on Thursday August 14th, at 9.00 A. M., the various sections held their separate meetings.

FINAL GENERAL SESSION.

On Thursday August 14th, at 1.00 P. M., the final general session was held in the Chemistry Lecture Room.

The reports of the secretaries of the different sections showed that the following officers had been elected for the coming year:—

Biology:	Chairman, Rev. J. A. Frisch
	Secretary, Mr. J. L. Harley
Chemistry:	Chairman, Rev. G. F. Strohaver
	Secretary, Mr. A. G. Carroll
Mathematics:	Chairman, Rev. F. W. Sohon
	Secretary, Mr. G. P. McGowan
Physics:	Chairman, Rev. J. A. Tobin
	Secretary, Mr. J. L. Murray

Next followed the report of the Committee on Resolutions. Fr. Lynch read the following resolutions, which were accepted as read:

The American Association of Jesuit Scientists, Eastern States Division, assembled at its Ninth Annual Meeting at Holy Cross College, presents the following resolutions:

1) That the Association expresses its gratitude to the Frs. Provincial for their kind encouragement and support of the work of the Association, shown especially by granting the members of the Association, at Weston and Woodstock permission to attend the meetings of the Association.

2) That we express our sincere thanks to Rev. Fr. Rector, in appreciation of the genuine hospitality extended by himself and his community to the Association; asking that he thank particularly Fr. Minister for having gone considerably out of his way to make everyone comfortable; and to the members of the various science departments for their generous time and service.

3) Inspired by the untiring zeal of, and in recognition of the renowned work done by Fr. Tondorf in the fields of Seismology, Geology and Astronomy; that a new section of Seismology, Geology and Astronomy be formed; and in gratitude for what Fr. Tondorf has done for the Association and the Society in his own field, that each member of the Association who is a priest be asked to say one Mass (first intention) for Fr. Tondorf, and each non-priest offer one Mass, Holy Communion and Rosary for the same intention.

The report of the Committee Meeting of Science and Philosophy was now read by Fr. Lynch.

A list of the terms to be defined and the topics they wished explained was presented by the spokesman of the Philosophers. The list is to be circulated among those teaching Philosophy with the request that it be added to as each sees fit. This revised list is to be sent to the President of the Association before Christmas. The President will then

send the topics and terms to be explained and defined to suitable men of the sections concerned, e. g. Evolution to Biology, etc. so that the answers can be back in the hands of the Philosophers for discussion and criticism at their Easter meeting.

The President, Fr. Schmitt, had prepared a mimeographed List of Topics to be discussed at the final General Session. These topics were now discussed:

1) Should the Secretaries continue the practice of sending Postals each month requesting articles for the Bulletin?
   A majority vote decided in favor of the affirmative.
2) It was suggested that a list of new scientific books appear from time to time in the Bulletin.
   It was also suggested that more Book Reviews appear in the Bulletin. Special attention was drawn to the translation of Fr. Wolff's "'Modern Physics' published by Dutton and Co.
3) Should we have a revision of membership?
   A majority vote decided that those who did not answer the cards asking the member whether he wished to continue his membership should be dropped; this revision is to be made by the Executive Council.

* *

After the completion of the above mentioned business, the election of officers was held:

Father Clarence E. Shaffrey was elected President.

Mr. Edward S. Hauber was elected Secretary-Treasurer.

* *

At a meeting of the Executive Committee, Fr. Richard B. Schmitt was appointed Editor of the Bulletin; and the following members were admitted to the Association:

Fr. Joseph Assmuth	Paul Fitzgerald
Fr. Joseph J. Daley	Gerard Landry
Lawrence Brock	Joseph Moynihan
Francis Doino	Lloyd Smith
Austin Dowd	Joseph Sweeney
Joseph Doherty	William Walter
Joseph Keegan	

* *

The following members of the Association were present at this Convention:

Anable, E. A.	Love, Rev. T. J.
Assmuth, Rev. J.	Lynch, Rev. J. J.
Bahlman, G. H.	MacLeod, Rev. H. C.

Berger, C. A.
Brock, Rev. H. M.
Brock, L. M.
Brown, Rev. T. J.
Buckley, Rev. R. J.
Busam, Rev. J. S.
Carroll, A. G.
Coniff, A. A.
Coyle, Rev. G. S.
Dore, Rev. F. J.
Doucette, Rev. B. F.
Duross, J.
Fey, L. F.
Fitzgerald, P.
Freatman, Rev. H. S.
Frisch, Rev. J. A.
Gorman, L. J.
Harley, J. S.
Hauber, E. S.
Keegan, J. G.
Kelly, Rev. J. M.
Kolkmeyer, Rev. E. J.
Landrey, G. M.
Loeffler, J. D.
Logue, Rev. W. G.
MacCormack, Rev. A. J.
McGowan, G. P.
McNally, Rev. P. A.
Merrick, Rev. J. P.
Molloy, J. J.
Moynihan, J. J.
Muenzen, Rev. J. B.
Murray, J. L.
O'Callahan, J. T.
O'Connor, Rev. J. S.
Power, Rev. F. W.
Reardon, Rev. F. X.
Roth, Rev. A. C.
Roth, Rev. C. A.
Schmitt, Rev. R. B.
Shaffrey, Rev. C. E.
Sheehan, W. D.
Smith, Rev. J. P.
Smith, L. F.
Sohon, Rev. F. W.
Strohaver, Rev. G. F.
Sullivan, Rev. J. J.
Sweeney, J. J.
Tobin, Rev. J. A.
Walter, W. J.

ABSTRACTS

BIOLOGY

The Training of Biology Teachers

Rev. John A. Frisch, S. J.

There is a lamentable lack of Catholic biologists engaged in research work. The blame must be placed on our schools, where little research work is done by the staff. The only way of cultivating the spirit of research is by bringing the student in contact with professors engaged in research work and by introducing the student to such work even in his undergraduate days.

At Georgetown a plan is in progress to build up a training school for biology teachers in which research work will play a prominent part.

Our other colleges can cooperate by freely giving us any suggestions their experiences have found practical, and by sending us interested students.

We think Georgetown particularly suited for this development. Besides our well staffed and equipped biology department, we have at our disposal our medical and dental and hospital faculties and laboratories. Moreover, the heads of the various bureaus of the Federal Department of Agriculture, of the Bureau of Fisheries, and of the Hygienic and Public Health Laboratories have expressed themselves as eager to cooperate with us. Furthermore, all the facilities of the National Museum, the Army and Navy Medical Museum, the Congressional Library, the Surgeon General's Library and the Public Health Library are, we might say, next door to us.

We feel that we would have no difficulty, in placing the men trained by us in teaching or laboratory positions because of our extensive contacts in Washington, and through our staff, in schools all over the country.

* *

A Comparative Study of Mushrooms

Rev. Harold L. Freatman, S. J.

This paper chiefly considered one division of the Eumycetes, the Basidomycetes. Briefly the Ascomycetes seem to bear some connection to the Red Algae, because of archegonia and antheridia, but some may be sterile. The Helvella is the best developed. Where sexual organs are wanting, the typical Ascus with eight spores arises from the mycelium directly.

The Basidiomycetes no longer possess sexual organs, and have a common four-celled tubular basidium. Only the red bears organs, which however are sterile. The relation of Basidiomycetes to the Ascomycetes is not so clear. The commonest bear gills, pendant from

a pileus which is borne on a stalk. Uredineae and Auriculariae have a basidium divided transversely into four cells. Tremellineae has a basidium divided longitudinally into four cells. The Exobasidiniae, Hymenomycetes, and Gasteromycetes have a unicellular basidium with, as a rule, four spores at the summit, sessile or on a stalk Ustilageneae are peculiar in that some have divided basidia, others undivided. Generally Basidiomycetes bear basidia upon or within more or less complicated fructifications. The higher the type of fungus the more the sporophores show a tendency to aggregation of their fruiting portions. Lower Basidiomycetes resemble Ascomycetes in their life-cycle, as they have a union of female gametangia, or of two or more sexual cells, or nuclei in the same cell or of two vegetative hyphae. Higher types allow no introduction of fóreign nuclear material.

Fungi seem to have an inherent contradiction in their decline of sexuality and ascent in structure of the fructifications. Fruit of the highest types may be gymnocarpous as in crusts, hemiangiocarpous as in pileate forms, or angiocarpous where a veil covers the spore-layer. This is to be seen from an examination of common species of these types.

* *

Changes In the Genital Fold Which Determine the Position of the Ovary

Rev. Clarence Shaffrey, S. J.

There is need to explain the position of the ovary on the dorsal surface of the broad ligament, for should the descent of the ovary be as that of the testicle we would expect to find the ovary on the ventral rather than on the dorsal surface of the broad ligament.

Several embryologists state that the ovary not only rotates into a transverse position, but passes through an arc of 180° to finally become attached to the dorsal surface of the broad ligament. Why, or under what influence this hurtling of the ligament takes place is not explained.

A very simple explanation of the position of the ovary is given by McMurrick: "Since the genital ridges form upon the mesial surfaces of the Wolffian ridges and the tubal portions are their lateral portions, when these latter untie to form the broad ligament the ovary will come to lie upon the dorsal surface of that structure, projecting into the recto-uterine pouch." Illustrated.

THE GENE

Charles A. Berger, S. J.

The Gene is the indefinite "factor" of Mendel given a name and a hypothetical habitation in the chromosomes. Wilson defines the gene as "the unit of Mendelian heredity; an hypothetical elementary entity that is essential to, or determines the development of, a particular character." The little information we have about the gene consists of evidence in support of its existence and descriptive of its method of action, of the nature of the gene we know next to nothing. This evidence is independent of the chromosome theory of heredity and would be just as true on the supposition that the genes did not reside in the chromosomes.

A brief summary of the steps in the formation of the theory of the gene and of the evidence on which they rest is as follows:

1. Genes are paired elements in the germinal material, to which the characters of the organism are referable. At the maturation, to germ cells the members of each pair are separated and each germ cell comes to contain only one set of genes. The evidence for this statement is all the experiments illustrating Mendel's first law of segregation.

2. Genes are linked together in a certain definite number of linkage groups which never exceed the number of chromosomes. Evidence: all breeding experiments illustrating linkage.

3. The genes in different linkage groups assort independently. Evidence: all Mendelian experiments illustrating independent assortment, Mendel's second law slightly modified.

4. The genes in corresponding linkage grouped undergo, at times, an orderly interchange called crossing-over. Evidence: numerous experimental breeding cases showing crossing-over.

5. The genes in any linkage group are arranged in linear order. Evidence: crossing-over experiments show that the relation of the genes in any linkage group to each other is the mathematical relation of points in a line.

6. The relative frequency of cross-overs gives evidence as to the relative position of each gene in the linear order of the linkage group.

7. The gene is not the determiner of a hereditary character but the differential factor in its determination. Evidence: the modern concept of the cell as a complex reaction system.

8. The gene is specific in as much as its presence is required to bring about a certain definite end result.

9. The gene is stable, at least relatively so, as is shown by its constancy in all breeding experiments.

10. Certain genes affect more than one character and certain characters are the result of the action of more than one gene. Evidence: cases of experimental breeding showing multiple factors and multiple effects.

11. Some unsupported suggestions as to the nature of the gene are: 1st, genes are enzymes; 2nd, genes are substances determining the production of enzymes; 3rd, genes are indefinite masses of material fluctuating about a mode; 4th, genes are organic molecules.

* *

A High School Biology Club

James L. Harley, S. J.

I PURPOSE of Club.

1st. To spur on the leaders of the class and keep them from catching the spirit of some of the loafers.

2nd. To awaken an interest in Biological subjects and scientific reading.

3rd. To supply the Biology department, in a small way, with micro-slides, botanical specimens etc.

II MEMBERSHIP.

The leaders of the class, those having a mark of over 85%.

III WORK of Club.

a) Simple Technique work. Starting with the making of micro-sildes of wing of butterfly, epidermis of leaf, epithelial cells of mouth, spirogyra etc. Use of the Microtome. Staining.

b) Preparation of Museum Specimens. Such as exhibits of leaves, seeds etc. Making of Riker Mounts. Placing specimens in display jars.

c) Writing papers on Biological subjects. The best of these can be read at the meetings or even published in the High School Magazine. Subjects could be: 'The Human Camera—the Eye', 'Non-Stop Flights—Bird Migration', 'Nature's Food Factory, the Green Leaf,' 'Endurance Record of the Heart', 'Methods of Seed Distribution', etc.

d) As a help to writing the above papers, a small reference LIBRARY may be kept, and some of the more popular or elementary biology books could be lent to the boys. Nature books such as 'Sharp Eyes' by Gibson, or Fabres Works or even High School Biology text books as those of Hunter or Moon may be found helpful.

e) If the Club can afford it, subscriptions can be taken for such Magazines as Nature, National Geographic, Scientific American etc. Copies of these can be lent to the boys for limited periods.

f) Visits to the 'Zoo' and the Botanical Gardens or to the various Museums of Natural History.

g) Field Trips in Autumn and Spring. These trips can take the form of a picnic a la Woodstock i. e. with dinner cooked over a camp fire. Such trips not only show the

boys that Biology is a LIVING subject but they also bring the boys into closer contact with Nature and make their study a pleasure. On these trips botanical specimens may be gathered, and ample material for the classroom Aquarium and the Biology Museum may be obtained.

IV TIME for Meetings.

This depends on local conditions. In schools where Friday is a half day, the meeting can be held every Friday afternoon from 1 to 3.

Of course all this supposes that the teacher has a little extra time to give to this work and that he is not too over-burdened with other 'side-jobs'. Generally where the teacher himself is interested and when he has sufficient time to devote to such a club, there is not much difficulty in keeping the boys interested.

* *

Did the Ammophila Urnaria of the Peckhams use a Pebble as a Tool?

Rev. John A. Frisch, S. J.

The Peckhams observed a hunting wasp, Ammophila urnaria, employing a pebble to pound in the dirt it was using to close the tunnel of its nest. This action they claimed as evidence of intelligence in this unusual insect.

By repeated observations in the field it was determined that Ammophila urnaria uses, besides the soil which it has excavated, such bulky material as lumps of dirt, pebbles, bits of wood and male pine cones to close the tunnel of its nest. This was a habit of all the individuals observed.

As often as not these large particles after having been pushed into the tunnel are pulled out again and put aside to be used again later on. One gathers the impression that they do not fit. At times these particles seem to be used to pound in the finer soil.

Such being the habit of all the individuals of this species, it is quite possible that the insect should use the same pebble or bit of wood repeatedly. Such use would not be an evidence of intelligence but a chance occurence in the insect's habitual routine.

If the Ammophila observed by the Peckhams had been the only individual of the tribe to use a pebble the observers would have had some foundation for their argument.

CHEMISTRY

The Separation of Cobalt and Nickel by Sodium Hypochlorite

Rev. Richard B. Schmitt, S. J.

In the first part of this paper, the four standard methods for the separation of nickel and cobalt from other elements were discussed. Outlines were given for the precipitation of nickel by dimethylglyoxime and by alpha-benzil-dioxime. Then it was shown that nickel is not deposited by electrolysis from strongly acid solutions and that the deposition of a weakly acid solution is incomplete. The cyanide method is not suited for accurate determinations.

In the second part of the discussion were given the essential features of the separation of cobalt from other elements. The methods given were the electrolytic method, the potassium nitrite method and the nitroso-beta-naphthol method.

Then followed a synopsis of the work done in the laboratory of the separation of cobalt and nickel by the fractional precipitation with sodium hypochlorite. The details of the experiments were outlined in reference to the effect of concentration of normal and half normal solutions. The second series of experiments outlined were in reference to the time of standing and the completeness of the separation. The results were given.

* *

Bromination of Choloroform

Rev. Joseph J. Sullivan, S. J.

This work was part of a problem the aim of which was to determine the strength of the last hydrogen bond in chloroform. The reaction expected was the substitution of hydrogen by bromine as follows:

$$CHCl_3 + Br_2 \longrightarrow CBrCL_3 + HBr$$

Carrying on this process at two different temperatures, two velocity constants could be obtained serving as limits in intergrating the well-known formula,

$$\frac{d\ln k}{dt} = \frac{A}{Rt^2}$$

where A represents the energy of activation.

Definite quantities of chloroform and bromine were introduced into a pyrex tube, the quantities always calculated to give a combined pressure in the vapor phase of less than two atmospheres. The pyrex tubes were sealed and heated in an electric furnace at 325° C for varying lengths of time. Residual bromine was to be estimated by the potassium iodide—thio—sulphate method.

The expected reaction, however, did not occur to any appreciable extent. Instead, fern-like clusters of crystals appeared on the walls of the tubes on cooling. Melting point (or rather sublimation-point), solubility, crystalline appearance pointed to dibromo-tetrachlor-ethane. Also a closed-tube melting point test, used by K. Yardley for the same substance (cf. Proc. Roy. Soc. (London), A 118, 449 (1928)) gave confirming weight to the above inference.

The reaction, therefore, involved the substitution of two bromine atoms, the loss of two chlorine atoms, and polymerization. Similar polymerization of chloroform heated by itself in a vessel of constant volume giving as a product hexa-chloro-ethane was noted by Herndon and Reid. (cf. J. A. C. S., 50, 3066 (1928))

* *

An Automatic Glass Electric Still

Lawrence C. Gorman, S. J.

The evaporator is a 1500 ml. pyrex ballon flask in an inverted position, and this is attached by means of a rubber stopper to the top end of an upright 60 cm. Leibig condenser. Both the inner tube and the outer casing of the condenser extend through the stopper into the flask, the inner tube approaching to within one cm. of the bottom of the inverted flask. It is important that the space between the inner tube of the condenser and its casing be not sealed by any means, because it is through this space that water enters and leaves the evaporator. An electric heating unit is placed within the flask. Water is supplied through the lower arm of the condenser, is preheated in the condenser, and passes into the evaporator through the space left free between the inner tube and the casing of the condenser. Excess water leaves through a constant water level which is attached to the upper arm of the condenser. The whole apparatus is mounted on an iron support and is easily moved about. Its capacity is one liter in forty five minutes.

A simple arrangement for protection against burning out the heating unit through accidental failure of the water supply is an adaptation, to the constant water level, of an idea explained in the Anal. Edit. of the Ind. and Eng. Chem., Vol. 2. No. 2 Page 197. The still may be made entirely automatic, i. e., self starting and self stopping, by means of a float placed in the distilled water tank. When the distilled water reaches a predetermined low level, the float opens a stopcock which allows water to flow into the evaporator, and closes a mercury switch connected to the heating unit. When the distilled water reaches a predetermined high level, the float causes these actions to be reversed,—it shuts off the water supply and breaks the electric curcuit. A diagram of this piece of apparatus may appear in a future issue of the bulletin.

The Co-Precitation of Copper by Nickel Dimethylglyoxime as a Function of pH.
REV. GEORGE F. STROHAVER, S.J.

A Study of the Electrolytic Determination of Copper in the Presence of Platinic Ion.
JOSEPH J. MOLLOY, S.J.

The Effect of Substituents of Certain Physical Properties of Picrates.
EDWARD S. HAUBER, S.J.

Synthesis of the Flour Hippuric Acids.
ALBERT F. McGUINN, S.J.

Note: The four above mentioned papers were given at the meetings of the chemistry section, but as the work has not been completed these papers will be published later.

PHYSICS

THE ORIGIN AND DEVELOPMENT OF THE ETHER THEORY

Very little data seems to be available with regard to the Ether Theory much before the beginning of the 19th century. For while it is true that the Wave Theory of Light was known long before it was accepted by the scientific world, having few defenders, little or no progress was made in attempting to justify philosophically, the theory which was scientifically an outlaw.

Among the first of what might be called the modern physicists to postulate an ether, and that in connection with the Wave Theory of Light, were Robert Hooke in England and Huyghens in Holland. Newton also had demanded an ether, but in connection with his Corpuscular Theory of Light. The crux of the whole difficulty of course was found in the impossibility of admitting anything like 'actio in distans.'

The question was finally brought to a head by Young in London in the year 1801, when the wave theory and the consequent necessity of an ether seemed to be completely demonstrated. For over a century the properties of the ether were so often modified and changed, owing to new discoveries, that no one might predict what would happen to the ether.

In recent years, some men prominent in the scientific world, have denied the necessity of an ether—others, equally as prominent, decided in its favor. The modern attitude seems best expressed in the words of Dr. Heyl of the Bureau of Standards: 'In one form or another, the ether will last as long as human thinking requires it.' Call it curved space, call it E-T-H-E-R, call it anything you like, the ether seems destined to remain with us.

Are Electrons Waves?

Rev. Henry M. Brock, S. J.

The existence of the electron was established some thirty years ago. Since then its properties have been carefully studied and it has obtained a place of increasing importance in theoretical physics. It has also found many practical applications as in radio, X ray tubes, television, talking pictures etc. The early experiments of Thomson and others indicated that electrons could be obtained from various gases and that their mass is about 1/1845 that of the hydrogen atom. In the Crookes' tube they act like negatively charged particles which are influenced by a magnet and which can be made to give up their charges to an electrometer as in the Perrin tube. Great skill was shown in measuring the charge upon a single electron, Millikan's results being the most reliable. Electrons are ejected from radioactive substances in the form of beta rays. They are emitted by in-

candescent metals and can be extracted from many substances by the action of light. All the evidence seems to prove not only the reality of the electron but also its corpuscular nature. Indeed the fluctuations observed in the electron current between a heated filament and plate in a vacuum tube indicate the random emission of particles possessing electronic charges. Wilson's cloud track experiments even indicate the paths of individual electrons.

The theories of Rutherford and Bohr regarding the structure of the atom are based upon the assumption that electrons are negatively charged particles. The latter theory, in spite of its initial success, has not proved altogether satisfactory and a few years ago Louis de Broglie, a brilliant young French physicist, suggested that, just as light has both undulatory and corpuscular properties, so under certain condition, especially in systems of atomic dimensions, particles may also posses wave properties. He assumed that with a particle of matter there is associated a wave motion such that the relationship between the velocity of the particle v and that of the wave u is given by the equation $uv=c^2$ where c is the velocity of light in vacuo. According to Einstein the energy equivalent of a particle of mass m is given by the equation $E=mc^2$. We have also the equation $E=hn$ where h is Planck's constant and n is the frequency. Equating these two values of E and making use of the relation $V=n\lambda$, we obtain $\lambda=h/mv$ as the wave length of a particle. It is inversely proportional to the momentum. After the publication of de Broglie's papers Elsassers in Germany suggested that evidence for the new wave mechanics would be found in the interaction of a stream of electrons and a crystal, just as at Laue's suggestion evidence for the wave nature of X rays was found in the interaction of a beam of X rays and a crystal.

A number of experiments along these lines have been performed during the past three or four years. G. P. Tnomson, the son of J. J. Thomson, sent a beam of high speed electrons through gold foil, allowing it to strike a photographic plate after transmssion. A central dark spot surrounded by concentric rings was obtained. It is difficult to see how particles could produce such a result. It can readily be explained however on the suppostion that the incident beam is a beam of monochromatic waves producing diffraction rings. The wave length obtained from the data of the experiment agrees closely with that computed from the de Broglie formula.

Another important series of experiments has been carried out by Davisson and Germer of the Bell Telephone Laboratories in New York They have studied in detail the reflection of a stream of electrons from a nickel crystal. A heated tungsten filament supplied the electrons which were directed against the face of the crystal. A cylindrical collector moving along a graduated arc and connected with a galvanometer received them after reflection. Their speed could be varied by varying the potential difference between the filament

and the collector. A number of similarities were found between electron reflection and X ray reflection. Electrons can be reflected from a crystal so that the angle of reflection is equal to the angle of incidence. If we consider the crystal as made up of regular layers of atoms very large in comparison with electrons and composed of nuclei with electrons revolving about them in orbits of comparatively large radius, a stream of electrons impinging upon the surface would be like comets entering solar systems. They would swing about the nuclei and after reflection would be scattered in different directions. If however we consider the beam as composed of waves, regular reflection would take place as in the case of X rays by reinforcement of secondary waves coming from layers of atoms in the crystal. Moreover X ray reflection shows selectivity. Thus when monochromatic X rays are directed against a crystal the intensity of the reflected beam at a given angle depends upon the wave length. Its intensity is a maximum when the wave length has the successive values 2dcos /n where d is the distance between the layers of atoms. In a similar way the intensity of a reflected beam of electrons is a function of the speed of bombardment. This is shown by plotting the intensity of the beam as ordinates and the square root of the bombarding potential as abscissae. A series of maxima is obtained. It was also found that by cutting the crystal in a particular way and reflecting a beam of electrons from the cut surface at different azimuths with normal incidence diffraction beams similar to the Laue diffraction beams characteristic of X rays could be obtained. A discrepancy between the directions of the reflected X ray and electron beams was explained by regarding the crystal as a refracting medium for electrons. The value of the index approaches unity as the speed is increased.

Davisson and Germer found a wave length of 1.65 A. U. for electrons with a potential difference of 54 volts. The value computed from the de Broglie formula is 1.67 A. U. Similarly for a potential difference of 65 volts the observed wave length was I.50 A.U. while the theortical value is 1.51 A.U. The argreement is remarkable in view of the experimental difficulties. While the evidence for the corpuscular nature of electrons still stands it appears that electrons moving with a velocity v have associated with them or under certain conditions act as if they were a beam of waves of wave length$\lambda = h/mv$.

Diamagnetism and Paramagnetism According to the Electronic Theory

Joseph L. Murray, S. J.

The fact that nearly all substances are affected in some way by magnetism had been discovered by Faraday in 1845. If he suspended a substance in rod form in a magnetic field, the rod, according to its composition, would take up a position either along the lines of force or normal to them. Whence came the names of Paramagnetism and Diamagnetism respectively. Ferromagnetism is a subdivision of par-

amagnetism and merits a distinctive name and treatment from the very exceptional and powerful magnetic susceptibility of iron.

The diamagnetic effect as explained by the Electronic Theory is shown to be intra-atomic and present in all atoms. It is however relatively weak and easily masked in the presence of paramagnetism. Where ever we have a purely diamagnetic substance, this substance is supposedly made up of magnetically neutral atoms. True, each moving electron in an atom is accompanied by its own magnetic field, but in the diamagnetic atom these fields individually and collectively are neutralized one by the other, so that looked at from the outside the diamagnetic atom is magnetically neutral. The torque necessary to twist a rod of a diamagnetic substance across the lines of force of a field is found in the reaction between the field itself and the minute magnetic fields of electrons which are moving in orbits *not parallel to the field.* According as these electrons are revolving clockwise or counter-clockwise we have attraction and repulsion, or vice-versa. A preponderance of electrons moving in one direction will cause an unbalanced force or torque which twists the atom across the lines of force.

In the paramagnetic atom it is assumed that the electronic magnetic fields within an atom are not completely neutralized, so that looked at from the outside the paramagnetic atom is really a minute magnet. As such it will, like a compass, aline itself with the field.

To explain the remarkable behavior of iron, cobalt, and nickel, it is assumed that the atoms of these substances react powerfully among themselves and form individual magnetic groups. In this, these atoms differ from the ordinary paramagnetic atoms which supposedly have little magnetic effect one on the other and act more or less as isolated units. The theory of "group reaction" in ferromagnetism covers all the peculiaritles which are commonly depicted in the Hysteresis Curve. This was demonstrated conclusively by Weber by means of his magnetic model. Each tiny compass needle of the model represented one magnetic group, and the reaction of one needle on its neighor was the only force needed to explain magnetic lag, saturation, retentivity and etc.

Millikan's Work on the Determination of the Charge on an Electron

Leo F. Fey, S. J.

This paper consisted of a brief resume of the work done on the determination of the charge on an electron prior to Professor Millikan and a more detailed description of Millikan's two experiments on the determination of ε. The paper outlined the assumptions used by Millikan's predecessors as well as the results of their determinations. Then was described Millikan's work in proving wrong some of these assumptions and correcting others. The Oil-Drop Experiment was examined very minutely as well as the formula whereby he attained his result.

The Piezo-Electric Effect

Rev. John A. Tobin, S. J.

Certain crystal substances, when subject to a mechanical stress, develop electric charges on their surfaces, or when an alternating source of potential is applied to the crystal, a charge in the physical dimensions may be osberved. This phenomenon is called the Piezo-Electric Effect.

In general any substance which is optically unsymetrical and exhibits doubly refractive properties is Piezo-Electically active. Natural quartz crystals are selected, since quartz is relatively plentiful and easy to obtain. In a natural crystal of quartz there are three sets of axes. The optic axis which passes through the center of the crystal parallel to the length, the electrical and mechanical axes which are situated at right angles to the optic axes, and although they are in the same plane, they are separted by an angle of 30°. Since the maximum piezo—electric effect is observed to be at right angles to the optic axis, the quartz crystals are usually cut with their surfaces parallel to the optic axis. There are two methods of cutting the quartz crystal. The first is called the "ZERO ANGLE" cut, since a normal to its major surface makes an zero angle with the electric axis, or the normal is parallel with X axis. The X or electric axes join the corners of the crystal. The Y axis or Mechanical axis joins opposite sides of the crystal. The second method of cutting a quartz plate is called 30°degree cut because the normal to the major surface makes an angle of 30°with the electric of X axis.

The two types of cuts show different characteristics. The main difference is in resonant frequency, and temperature control. The resonant frequency of a crystal is determined by the physical dimensions of the quartz crystal plate. Where great precision is required it is necessary to use some device to maintain the temperature constant.

The quartz crystal when used as a control element in a radio frequency oscillator is capable of handling only a limited amount of power. But the output from a crystal oscillator and a small power tube can be amplified to almost any level by the use of power amplifiers. These power amplifiers can be used at the same time to double the frequency since the higher frequencies are impracticable with a quartz plate.

The Shortt Synchronome Clock

Rev. John S. O'Connor, S. J.

This paper dealt with the construction of the precision time piece developed in the laboratories of the Synchronome Co., by F. Hope-Jones.

In particular, the two principles involved in its operation, were discussed. First, the principle of zero impulse, and secondly, that

of synchronization. The combination of the two in the Shortt Clock has resulted in what may be called the horologist's ideal.

The first consists of an escapement, (broadly so called) by which energy is transmitted to the pendulum, every 30 seconds, at the time when the pendulum is passing through its zero position,—that is when its velocity is a maximum, but its acceleration is zero. In this way the blow imparting the energy causes a minimum of interference with the free swing.

The second principle, that of synchronization, is applied in a combination of free and slave pendula, electrically connected and operated in such a way that the latter does all the work, such as releasing the energizing arm, etc., for both systems, while the former does nothing but keep time. The rate of the slave is kept close to that of the free pendulum by the above mentioned and ingenious synchronizing switch.

The accuracy of this timepiece was at first considered so perfect that Prof. De Sitter of Lyden called its rate absolutely invariable. However after observation for five years at the Greewich Observatory, errors of the magnitude of 1/5000 sec. and occasionally slightly larger have been found. These are attributed to variation in amplitude or arc, and to a growth in the pendulum rod, but are so small as to still give grounds for the hope that the clock may be used to measure possible variations in the rate of the rotation of the earth.

The Photo-Electric Effect

Joseph P. Merrick, S. J.

This effect is quite distinct from the thermionic effect. For the latter is attributable to an increase in molecular virbration which causes the free electrons to escape. The photo-electric effect is a cold effect that takes less than 3 billionths of second to produce.

We reject the Bohr hypothesis that the law of conservation of energy is only statisical for this effect, and also the hypothesis that the light is like a spark which detonates the energy that the atom itself possesses.

A photo of Wilson shows four photo-electrons being ejected simultaneously from a single atom. Auger showed that the energies of these four electrons is not greater than the original quantum of energy so refuting the detonation hypothesis. Again the photoelectrons have a forward component equal to the momentum of the incident ray which is not explainable on the wave or detonation hypotheses.

Finally Bother and Geiger showed 66 accurately simultaneous coincidences of recoil electrons and scattered quanta in five hours. If Bohr were correct the number of hours should have been 2,000,000. The conclusion in valid that radiant energy comes in chunks of $h\nu$ and that all the energy of the chunk goes into the emitted photoelectrons if it strikes an interior electron or into recoil electrons plus scattered quanta if it strikes free electrons.

The Axioms of Mathematics

Rev. Frederick W. Sohon, S. J.

The undefined terms of mathematics are only apparently undefined, for the unproved propositions really define and limit them. They represent universal concepts whose essential notes are given by the assumed postulate system.

A postulate system is said to be competent if it is self-consistent, and is sufficiently complete to permit logical deduction. All competent postulate systems are found to have a certain minimum common implication. Hence if a given proposition is contained in the invariant common implication of all competent postulate systems it is a necessary proposition, and is not dependent upon the choice of any particular postulate system. Thus there arises the concept of an absolute demonstration, as distinguished from ordinary or relative demonstration, which merely establishes a proposition relative to a given postulate system.

Propositions that are not necessary are called contingent. To drop a contingent proposition is generalization. To add a proposition to a postulate system that is consistent with, but not implied by the given system is specialization.

The fact that some of the postulates of geometry are contingent is shown by the four dimensional non-euclidean geometry of mechanics (since duration and length cannot be treated alike in all respects), and this is considered to be a valuable point gained over those who contend that the properties of space and time are knowable *a priori* antecedent to experimentation.

Mathematics of the Pre-Christians Centuries

George P. McGowan, S. J.

The purpose of this paper was to stimulate interest in the study of the birth and development of mathematics. The elementary notation used by pre-historic man was described, and the efforts of the early Babylonians, Phoenicians, Chaldeans and Egyptians were proven to have been the main-spring, from which the slowly-increasing and widening current of Grecian genius flowed onward through six centuries till finally it became a broad river of Mathematical knowledge, winding peacefully through the first ten centuries of the Christian Era. The division of the paper was threefold. The years 4000 B. C. to 1000 B. C., representing the contributions of Egypt and Chaldea, while the lesser Gracian Period from 1000 B. C. to 300 B. C. represented the findings of such famous men as Thales, Pythagoras and the Platonic School, whereas the sweep of Grecian mathematical thought, fertile with theoretical proofs of the empirical findings was shown to take place between the years 300 B. C. and 30 B. C., during which time the brilliant minds of Euclid, Archimedes and Apollonius of Perga formally elaborated the method and science of Mathematics and gave to it a definite mould.

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Barry, T. D., 1926. Weston College, Weston, Mass.
Berry, Rev. E. B., 1922. St. Andrew-on-Hudson, Poughkeepsie, N. Y.
Berry, Rev. E. B., 1922. St. Ahdrew-on-Hudson, Poughkeepsie, N. Y.
Carasig, Rev. P. M., 1923. San Jose Observatory, Manila, P. I.
Cusick, W. H., 1928. Weston College, Weston, Mass.
Dawson, Rev. J. F., 1922. St. Joseph's College, Philadelphia, Pa.
Depperman, Rev. C. E., 1923. San Jose Observatory, Manila, P. I.
Doucette, Rev. B. F., 1925. Weston College, Weston, Mass.
Fey, L. F., 1926. Woodstock College, Woodstock, Md.
Fitzgerald, P., 1930. Georgetown University, Washington, D. C.
Gipprich, Rev. J. L., 1922. Georgetown University, Washington, D. C.
Kelly, Rev. J., 1922. Loyola High School, Baltimore, Md.
Kennedy, Rev. W. W., 1923. Boston College, Boston, Mass.
Logue, Rev. L. R., 1923. Manresa Hall, Port Townsend, Washington.
Long, Rev. J. J., 1924. Woodstcok College, Woodstock, Md.
McCormack, Rev. J. T., 1923. Boston College High School, Boston, Mass.
McGowan, G. P., 1928. Georgetown University, Washingotn, D. C.
McLaughlin, Rev. T. L., 1923. Boston College, Boston, Mass.
McNally, Rev. P. A., 1923. Georgetown University, Washington, D. C.
Murray, J. L., 1925. Holy Cross College, Worcester, Mass.
Nuttall, E. J., 1925. Woodstock College, Woodstock, Md.
O'Callahan, J. T., 1929. Boston College, Boston, Mass.
O'Donnell, Rev. G. A., 1924. St. Andrew-on-Hudson, Poughkeepsie, N. Y.
O'Loughlin, Rev. F. D., 1923. Fordham University, New York, N. Y.
Phillips, V. Rev. Edward C., 1922. 501 E. Fordham Rd., New York, N. Y.
Quigley, T. H., 1925. Weston College, Weston, Mass.
Repetti, Rev. W. C., 1922. San Jose Obsevatory, Manila, P. L.
Roth, Rev. A. C., 1923. Canisius High School, Buffalo, N. Y.
Roth, Rev. C. A., 1923. St. Francis Xavier, New York, N. Y.
Setter, Rev. J. G., 1928. Canisius High School, Buffalo, N. Y.
Smith, Rev. J. P., 1923. St. Peter's College, Jersey City, N. J.
Sheehan, W. D., 1928. Holy Cross College, Worcester, Mass.
Sohon, Rev. F. W., Georgetown University, Washington, D. C.
Sweeney, J. J., 1930. Boston College High School, Boston, Mass.
Wessling, Rev. H. J., 1923. Boston College High School, Boston, Mass.

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Brock, Rev. H. M., 1922. Weston College, Weston, Mass
Brock, L., 1930. Boston College, Boston, Mass.
Crawford, Rev. W. R., 1924. Holy Cross College, Worcester, Mass.
Daley, Rev. J. J., 1930. Boston College High School, Boston, Mass.
Dawson, Rev. J. F., 1923. St. Joseph's College, Philadelphia, Pa.
Delaney, Rev. J. P., 1923. Canisius College, Buffalo, N. Y.
Depperman, Rev. C. E., 1923. San Jose Observatory, Manila, P. I.
Doherty, J. G., 1930. St. George's College, Kingston, Jamaica., B. W. I.
Doucette, Rev. B. F., 1925. Weston College, Weston, Mass.
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Fey, L. F., 1926. Woodstock College, Woodstock, Md.
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Hearn, J. R., 1925. Woodstock College, Woodstock, Md.
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Logue, Rev. W. G., 1923. Woodstock College, Woodstock, Md.
Love, Rev. T. J., 1923. Loyola College, Baltimore, Md.
Lynch, Rev. J. J., 1925. Forham University, New York, N. Y.
Mahoney, Rev. J. B., 1925. Ateneo de Manila, Manila, P. I.
McGowan, G. P., 1928. Georgetown University, Washington, D. C.
McNally, Rev. H. P., 1922. St. Andrew-on-Hudson, Poughkeepsie, N. Y.
Merrick, Rev. J. P., 1923. St. Andrew-on-Hudson, Poughkeepsie, N. Y.
Miley, Rev. T. H., 1923. St. Joseph's College, Philadelphia, Pa.
Moore, Rev. T. H., 1923. St. Joseph's College, Philadelphia, Pa.
Murray, J. L., 1928. Holy Cross College, Worcester, Mass.
Nuttall, E. J., 1925. Woodstock College, Woodstock, Md.
O'Callahan, J. T., 1929. Boston College, Boston, Mass.
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Roth, Rev. A. C., 1923. Canisius High School, Buffalo, N .Y.
Roth, Rev. C. A., 1923. St. Francis Xavier, New York, N. Y.
Sheehan, W. D., 1928. Holy Cross College, Worcester, Mass.
Smith, Rev. J. P., 1923. St. Peter's College, Jersey City, N. J.
Smith, T. J., 1926. Weston College, Weston, Mass.
Sullivan, Rev. D. H., 1923. Cagayan, Mindanao, P. I.
Tobin, Rev. J. A., 1923. Boston College, Boston, Mass.
Tynan, J.W., 1926. Woodstock College, Woodstock, Md.